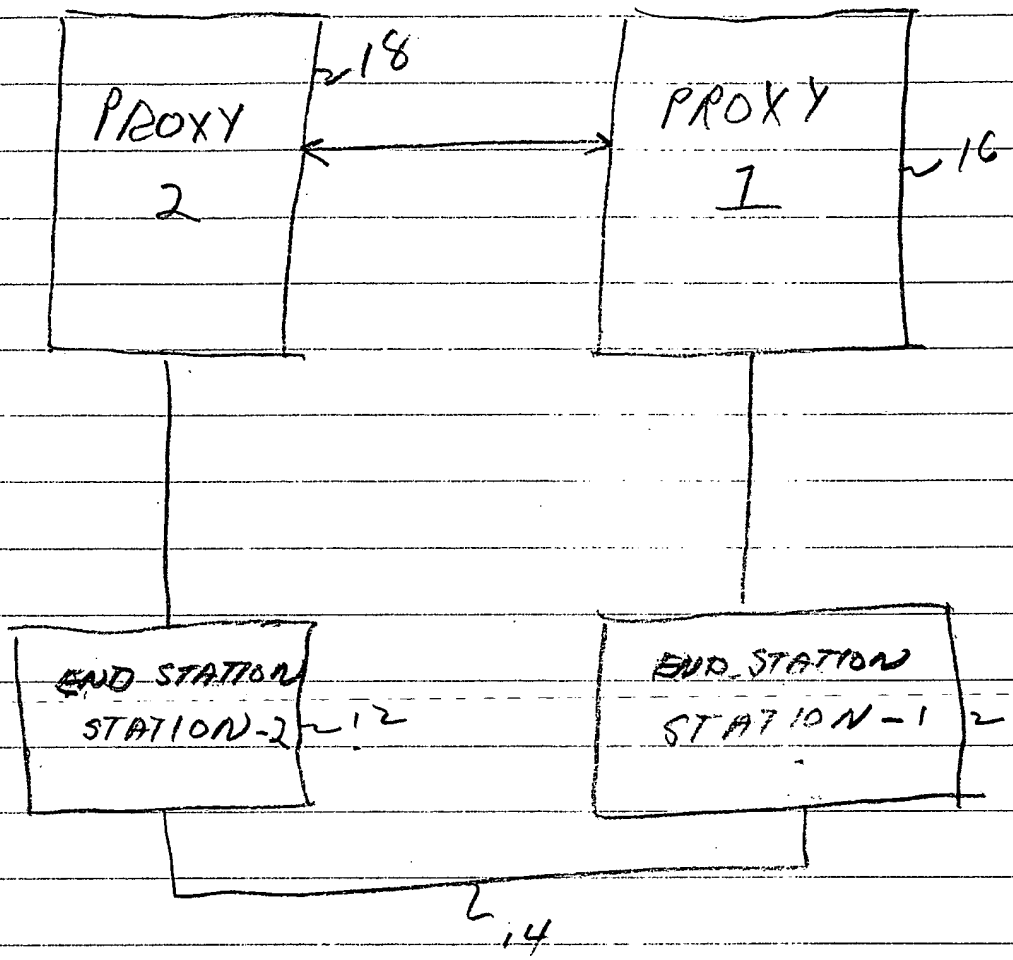
PROXY 2
18
PROXY 1
16
END STATION STATION-2
12
END STATION STATION N-1
10
14

FIG 1

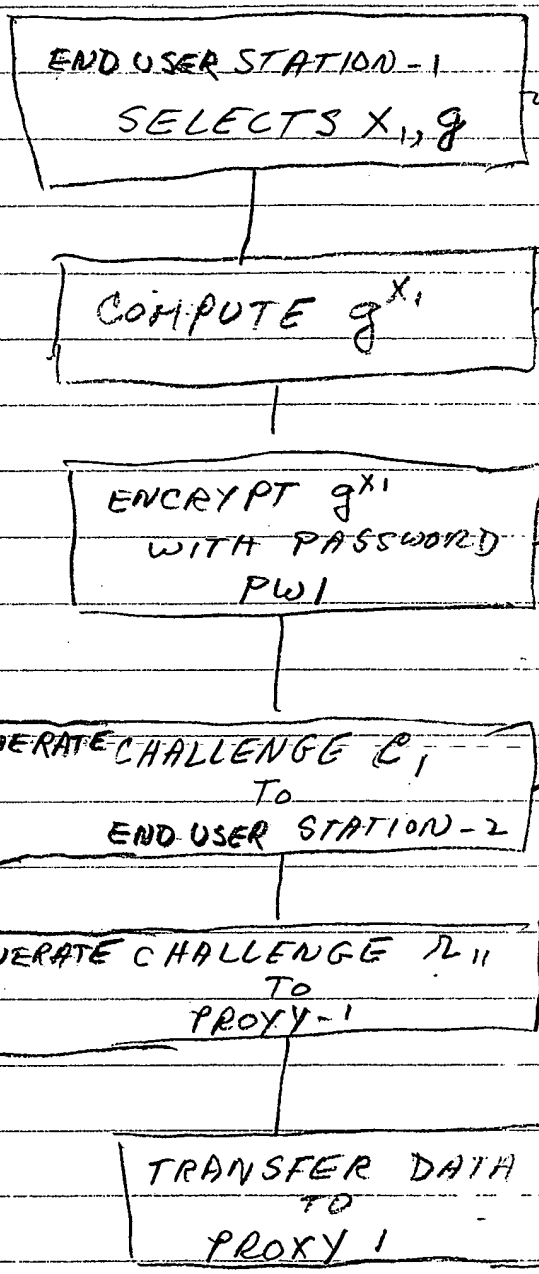
END USER STATION - 1
SELECTS X_1, g
20
COMPUTE g^{X_1}
22
ENCRYPT g^{X_1}
WITH PASSWORD
PW1
24
GENERATE CHALLENGE C_1
TO
END USER STATION - 2
26
GENERATE CHALLENGE Λ_{11}
TO
PROXY - 1
28
TRANSFER DATA
TO
PROXY 1
30

FIG 2

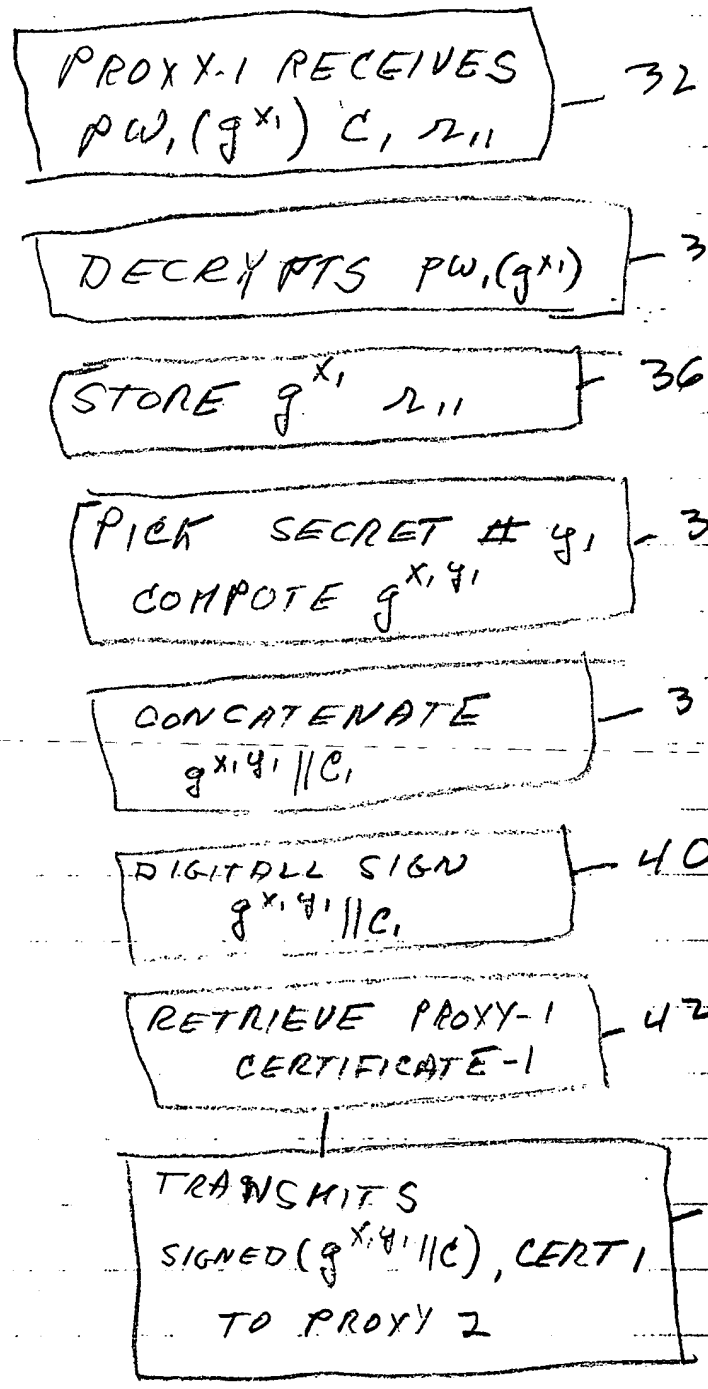
PROXY-1 RECEIVES
PW, (g^x1) C, n11
32
DECRYPTS PW, (g^x1)
34
STORE g^x1 n11
36
PICK SECRET # y1
COMPOTE g^x1,y1
38
CONCATENATE
g^x1,y1 || C1
39
DIGITALL SIGN
g^x1,y1 || C1
40
RETRIEVE PROXY-1
CERTIFICATE-1
42
TRANSMITS
SIGNED(g^x1,y1 || C), CERT1
TO PROXY 2
44

FIG 3

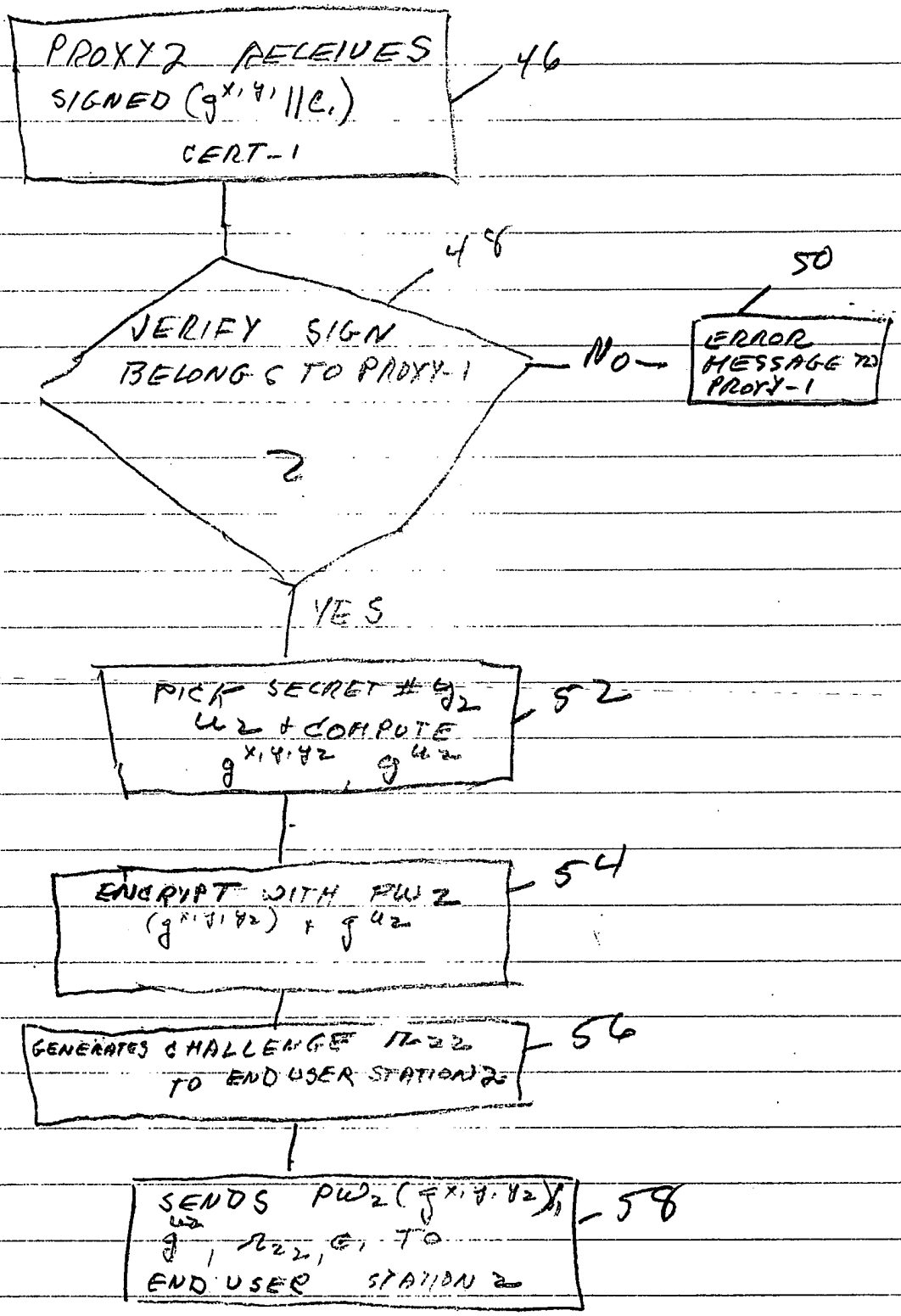
PROXY 2 RECEIVES SIGNED ($g^{x,y}$ || C.) CERT-1
46
VERIFY SIGN BELONG C TO PROXY-1
48
NO
50
ERROR MESSAGE TO PROXY-1
2
YES
PICK SECRET # y_2 u_2 + COMPUTE g^{x,y,z_2}, g^{u_2}
52
ENCRYPT WITH PW 2 $(g^{x,y,z_2}) + g^{u_2}$
54
GENERATES CHALLENGE n_{22} TO END USER STATION 2
56
SENDS $PW_2(g^{x,y,z_2}, g^{u_2}, n_{22}, C)$ TO END USER STATION 2
58

FIG 4

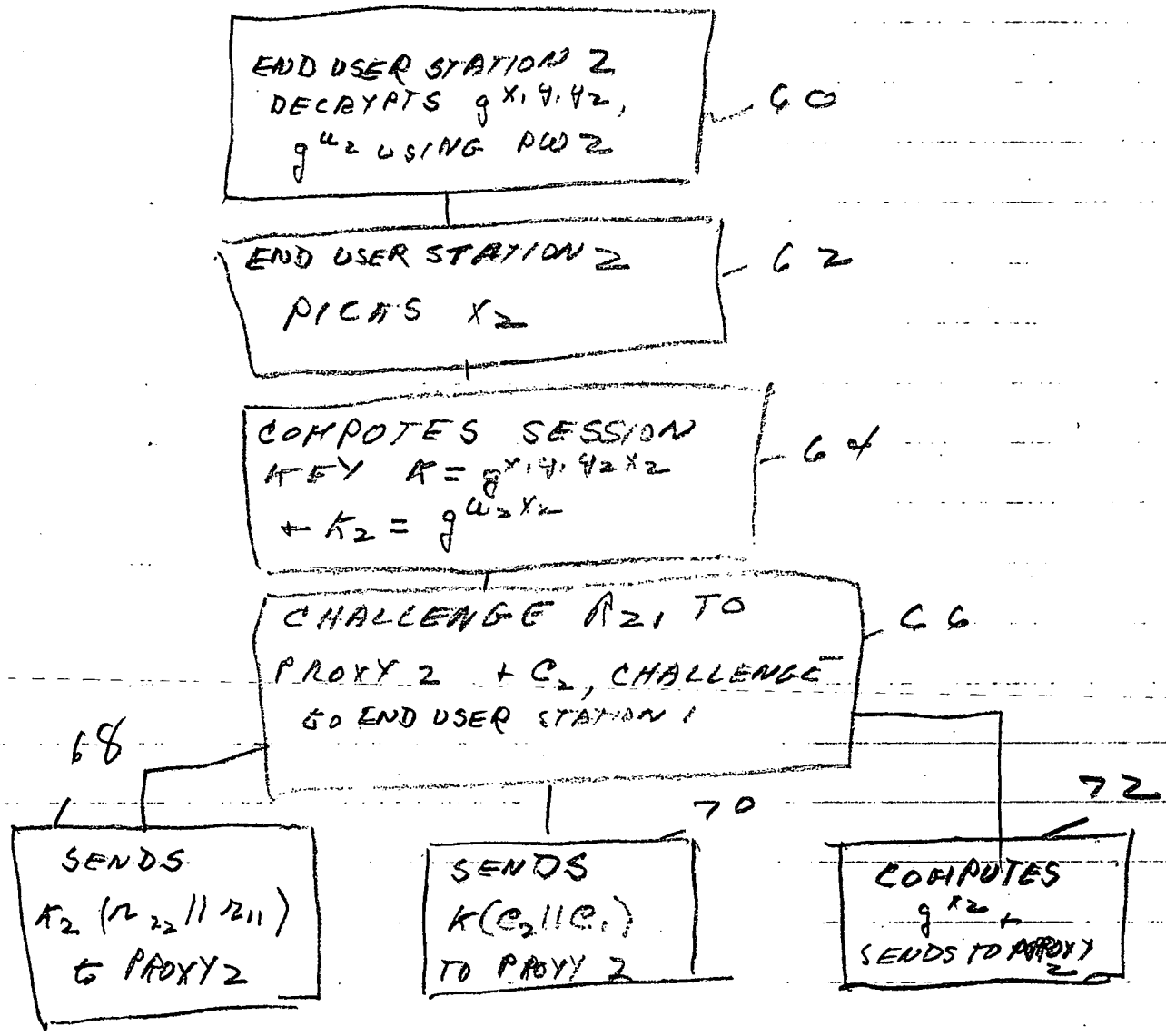
END USER STATION 2 DECRYPTS $g^{x_1}, g^{r_2}, g^{w_2}$ USING PW2
60
END USER STATION 2 PICKS x_2
62
COMPUTES SESSION KEY $K = g^{x_1 r_2 w_2 x_2}$ $K_2 = g^{w_2 x_2}$
64
CHALLENGE R_{21} TO PROXY 2 + C_2, CHALLENGE TO END USER STATION 1
66
68
SENDS $K_2(r_{22} \| r_{11})$ TO PROXY 2
70
SENDS $K(C_2 \| C_1)$ TO PROXY 2
72
COMPUTES g^{x_2} + SENDS TO PROXY 2

FIG 5

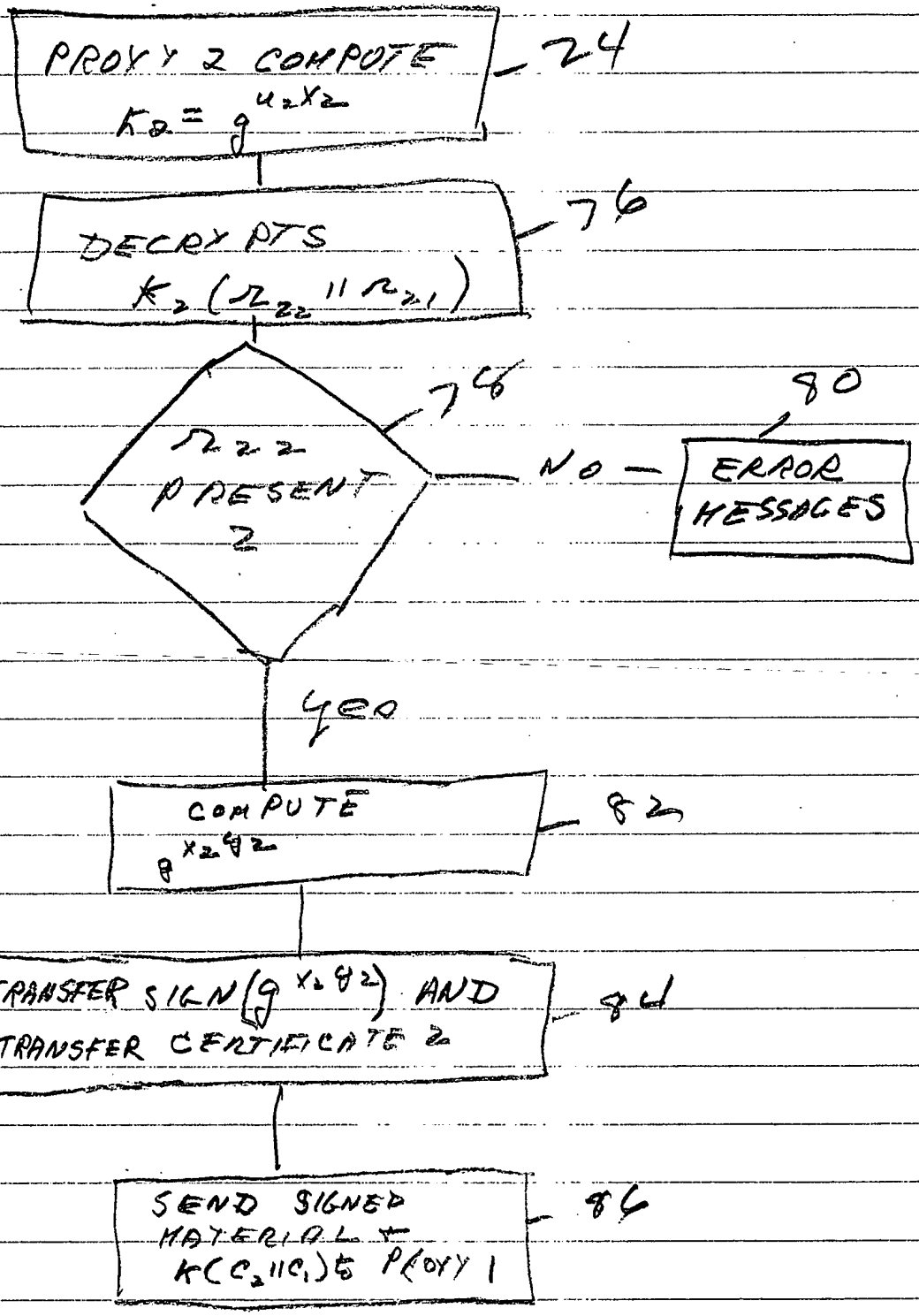
PROXY 2 COMPUTE
$K_2 = g^{u_2 x_2}$
24
DECRYPTS
$K_2(r_{22} \| r_{21})$
76
r_{22} PRESENT
78
NO
ERROR MESSAGES
80
YES
COMPUTE
$g^{x_2 g_2}$
82
TRANSFER SIGN$(g^{x_2 g_2})$ AND
TRANSFER CERTIFICATE 2
84
SEND SIGNED MATERIAL +
$K(C_2 \| C_1)$ & PROXY 1
86

FIG 6

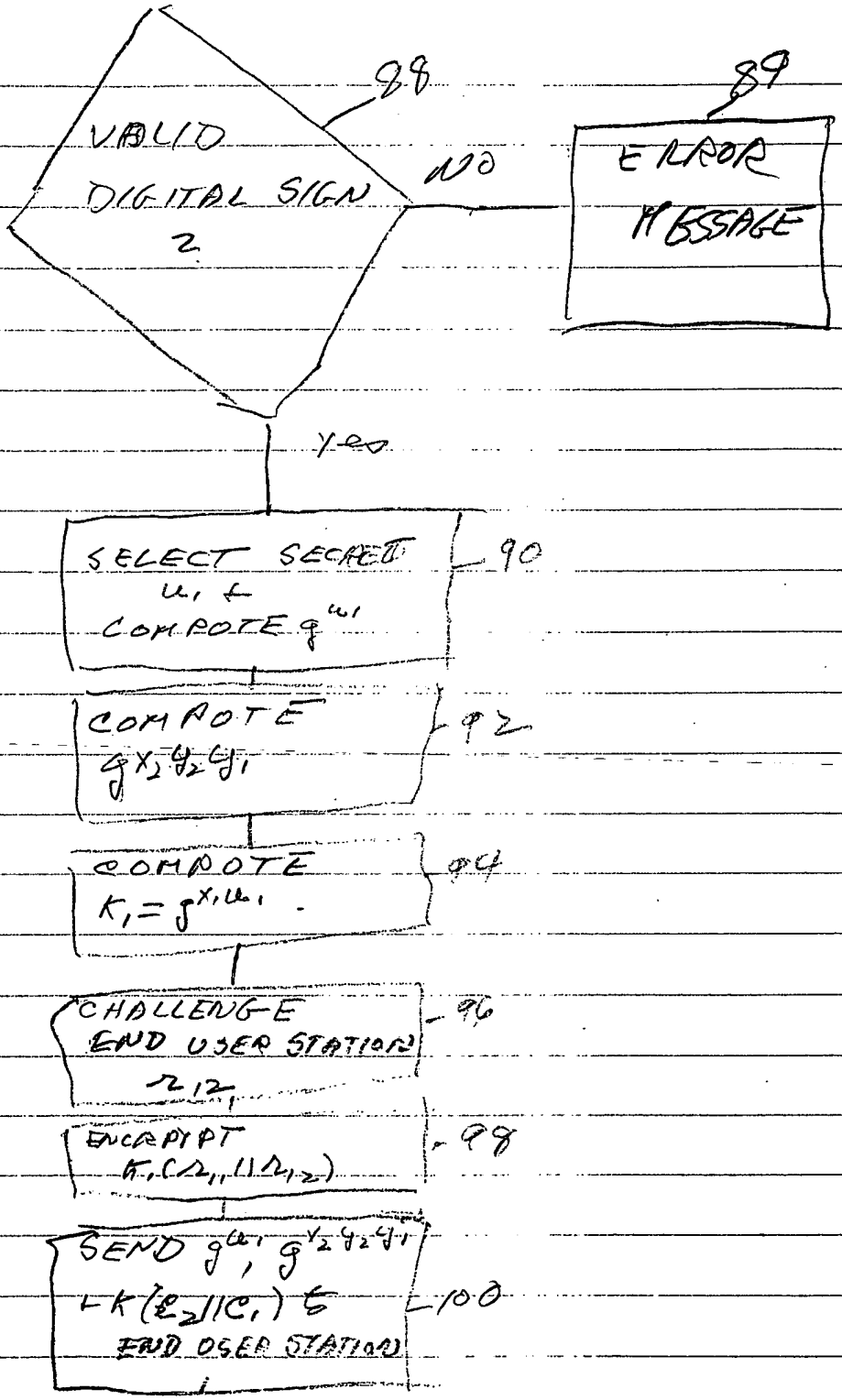
88
VALID DIGITAL SIGN 2
NO
89
ERROR MESSAGE
YES
SELECT SECRET u1 & COMPUTE g^u1
90
COMPUTE g^x1 y2 g1
92
COMPUTE K1 = g^x1 u1
94
CHALLENGE END USER STATION 2 r12
96
ENCRYPT K1 C(r11 || r12)
98
SEND g^u1, g^v2 y2 g1 + K(r2 || C1) TO END USER STATION 1
100

FIG 7

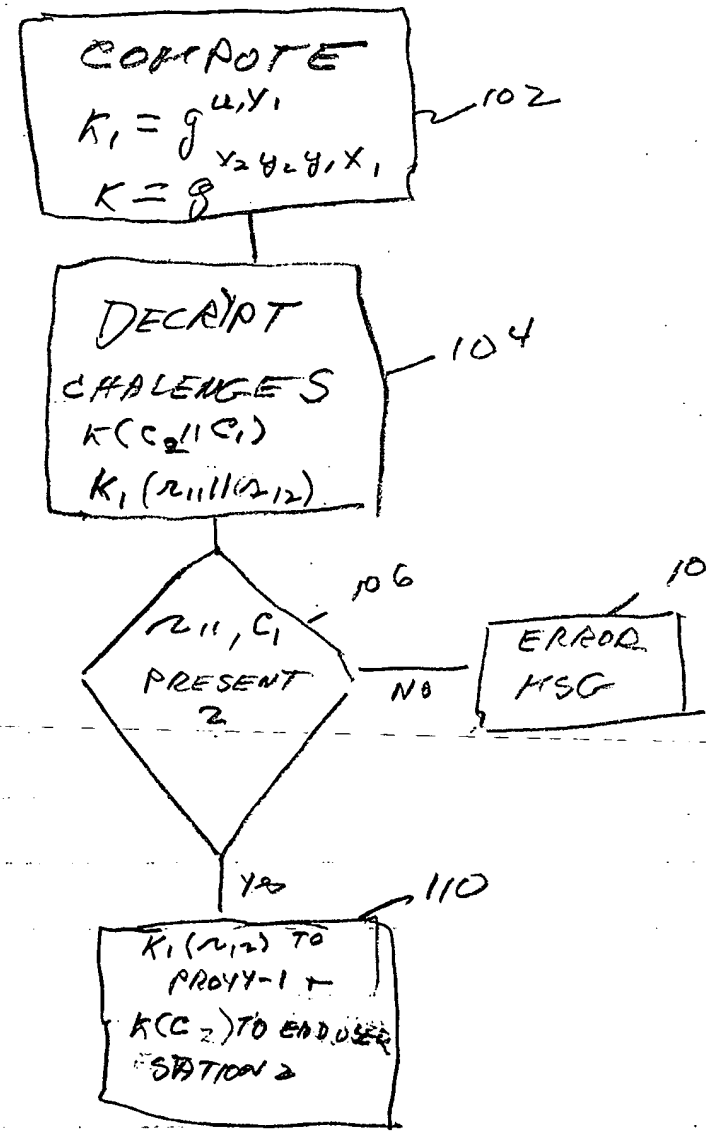
COMPUTE
$K_1 = g^{u,y_1}$
$y_2 y_2 y_1 x_1$
$K = g$
102
DECRYPT
CHALLENGES
$K(C_2 || C_1)$
$K_1(r_{11} || r_{12})$
104
r_{11}, C_1
PRESENT
2
106
NO
ERROR
MSG
108
YES
$K_1(r_{12})$ TO
PROXY-1
$K(C_2)$ TO END USER
STATION 2
110

FIG 8

HH &
P

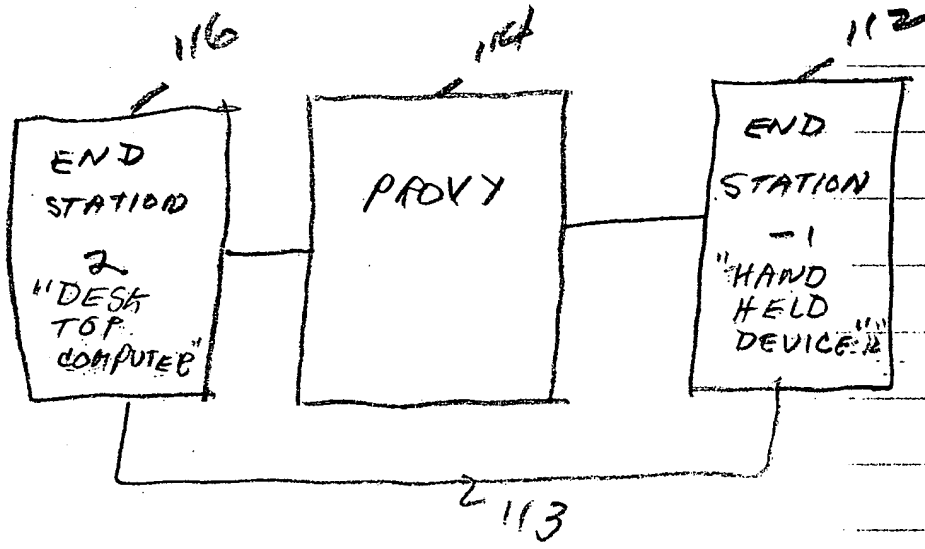

FIG 9

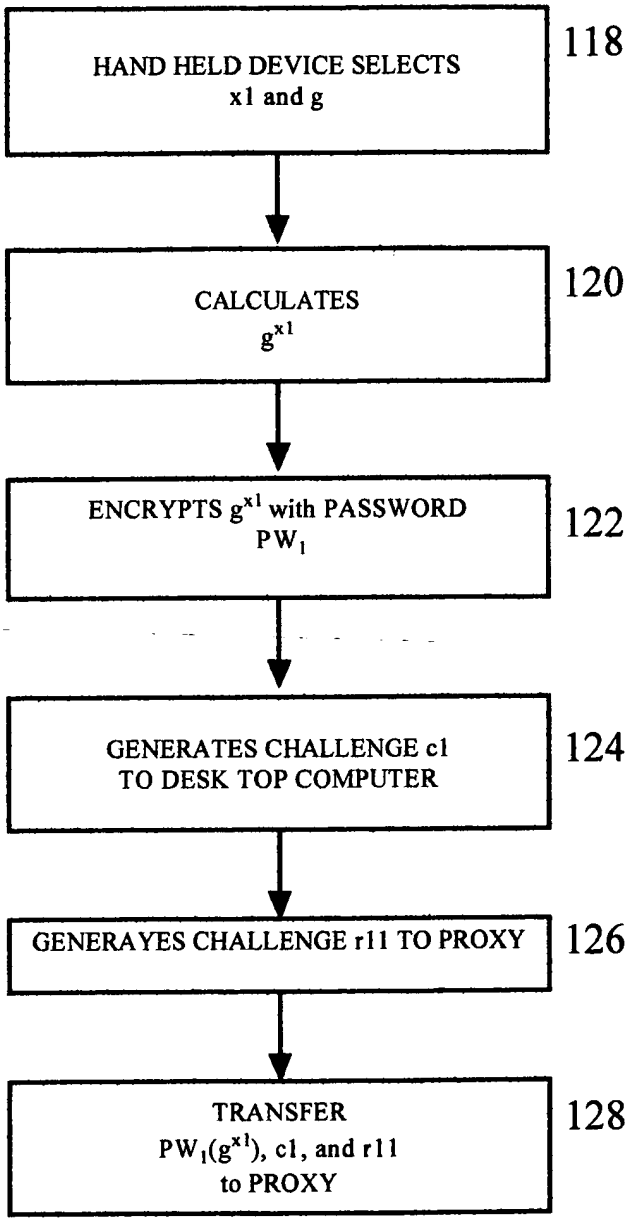
HAND HELD DEVICE SELECTS
x1 and g
118
CALCULATES
g^{x1}
120
ENCRYPTS g^{x1} with PASSWORD
PW_1
122
GENERATES CHALLENGE c1
TO DESK TOP COMPUTER
124
GENERAYES CHALLENGE r11 TO PROXY
126
TRANSFER
$PW_1(g^{x1})$, c1, and r11
to PROXY
128

FIG 10

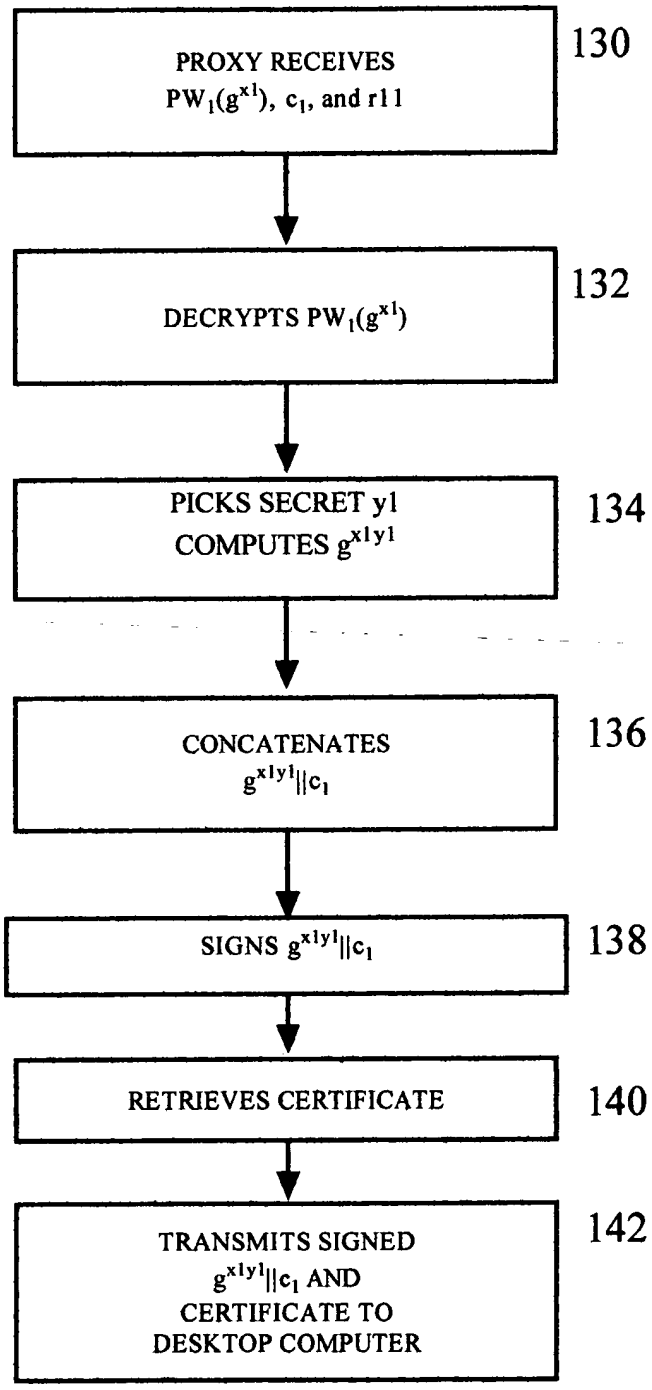
PROXY RECEIVES
$PW_1(g^{x1})$, c_1, and r11
130
DECRYPTS $PW_1(g^{x1})$
132
PICKS SECRET y1
COMPUTES g^{x1y1}
134
CONCATENATES
$g^{x1y1}||c_1$
136
SIGNS $g^{x1y1}||c_1$
138
RETRIEVES CERTIFICATE
140
TRANSMITS SIGNED
$g^{x1y1}||c_1$ AND
CERTIFICATE TO
DESKTOP COMPUTER
142

FIG 11

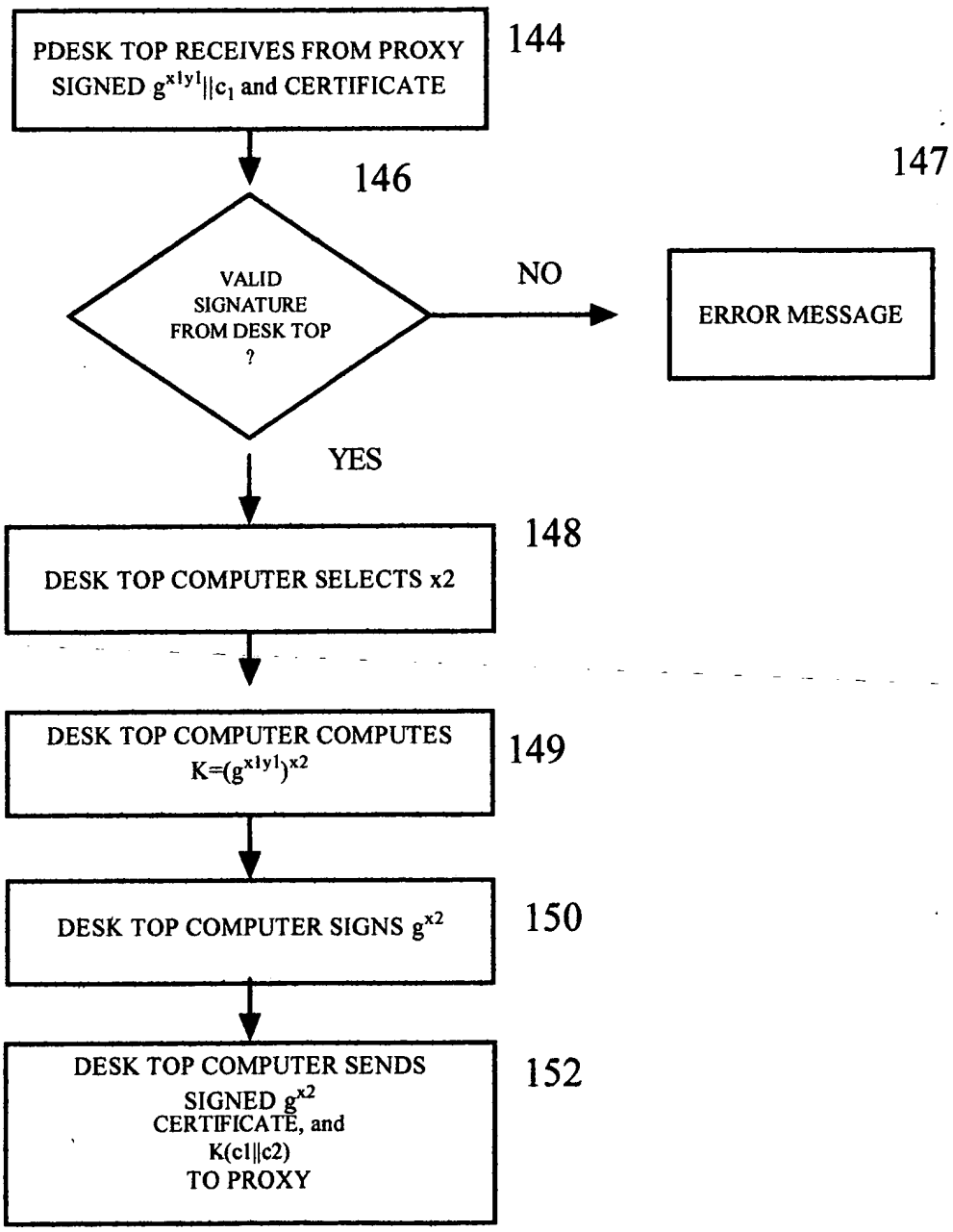
PDESK TOP RECEIVES FROM PROXY SIGNED $g^{x1y1}||c_1$ and CERTIFICATE
144
146
147
VALID SIGNATURE FROM DESK TOP ?
NO
ERROR MESSAGE
YES
148
DESK TOP COMPUTER SELECTS x2
DESK TOP COMPUTER COMPUTES $K=(g^{x1y1})^{x2}$
149
DESK TOP COMPUTER SIGNS g^{x2}
150
DESK TOP COMPUTER SENDS SIGNED g^{x2} CERTIFICATE, and K(c1||c2) TO PROXY
152

FIG 12

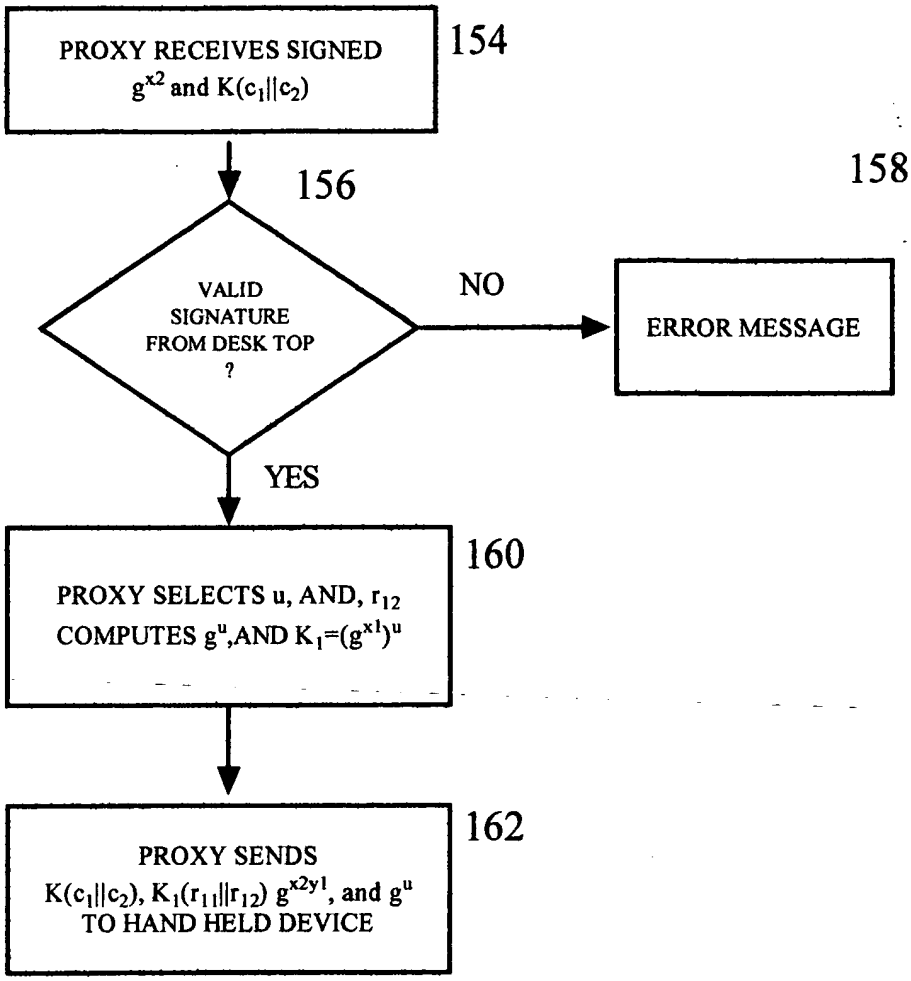
PROXY RECEIVES SIGNED
g^{x2} and $K(c_1||c_2)$
154
156
158
VALID
SIGNATURE
FROM DESK TOP
?
NO
ERROR MESSAGE
YES
PROXY SELECTS u, AND, r_{12}
COMPUTES g^u,AND $K_1=(g^{x1})^u$
160
PROXY SENDS
$K(c_1||c_2)$, $K_1(r_{11}||r_{12})$ g^{x2y1}, and g^u
TO HAND HELD DEVICE
162

FIG 13

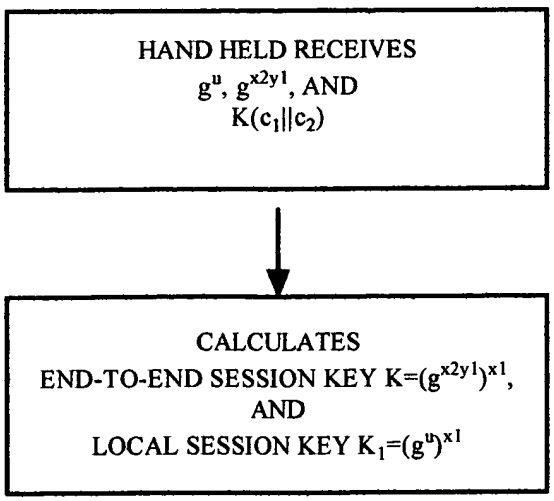

FIG 14

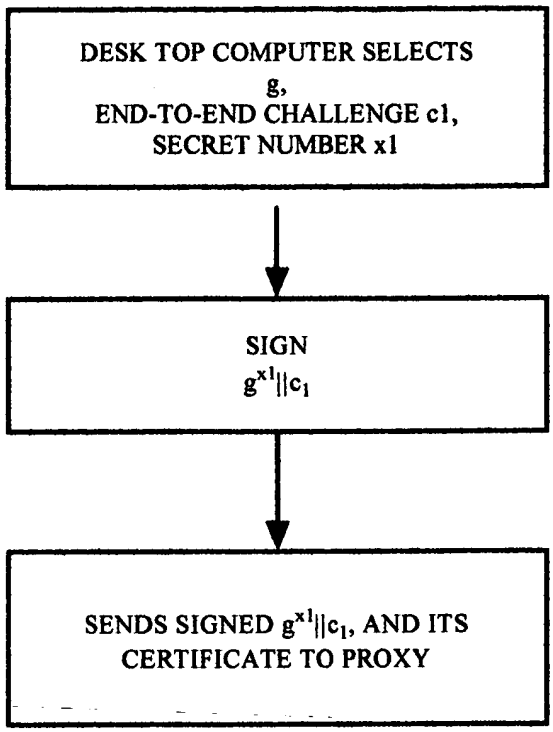
DESK TOP COMPUTER SELECTS
g,
END-TO-END CHALLENGE c1,
SECRET NUMBER x1
164
SIGN
$g^{x1}||c_1$
166
SENDS SIGNED $g^{x1}||c_1$, AND ITS
CERTIFICATE TO PROXY
168

FIG 15

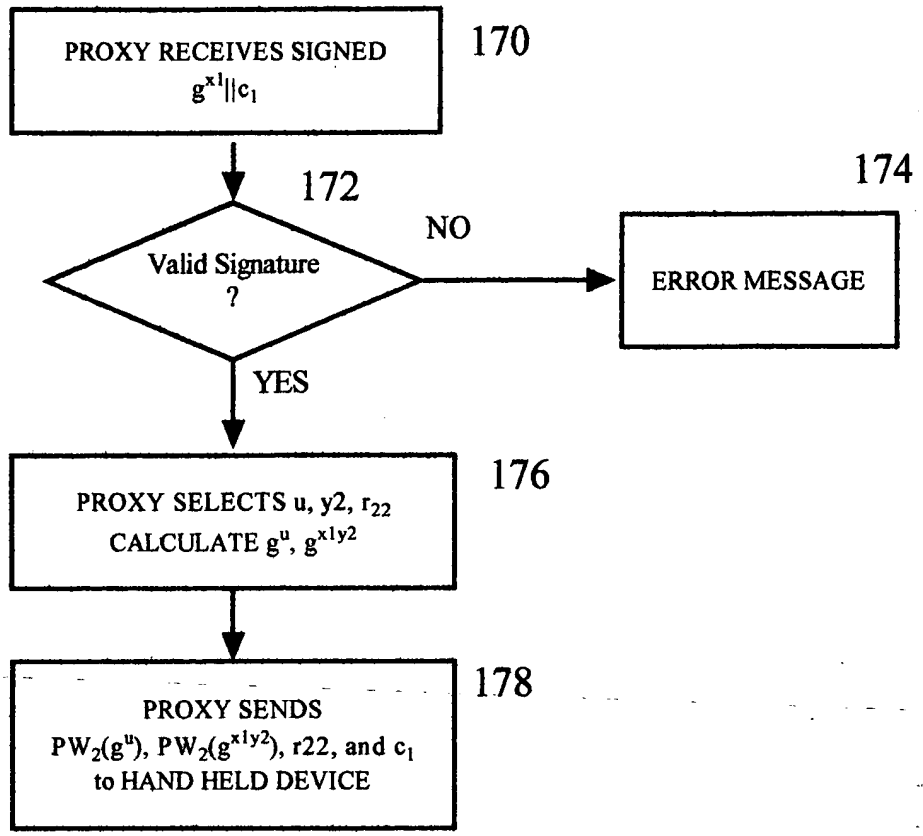
PROXY RECEIVES SIGNED
$g^{x1}||c_1$
170
172
Valid Signature
?
NO
174
ERROR MESSAGE
YES
PROXY SELECTS u, y2, r_{22}
CALCULATE g^u, g^{x1y2}
176
PROXY SENDS
$PW_2(g^u)$, $PW_2(g^{x1y2})$, r22, and c_1
to HAND HELD DEVICE
178

FIG 16

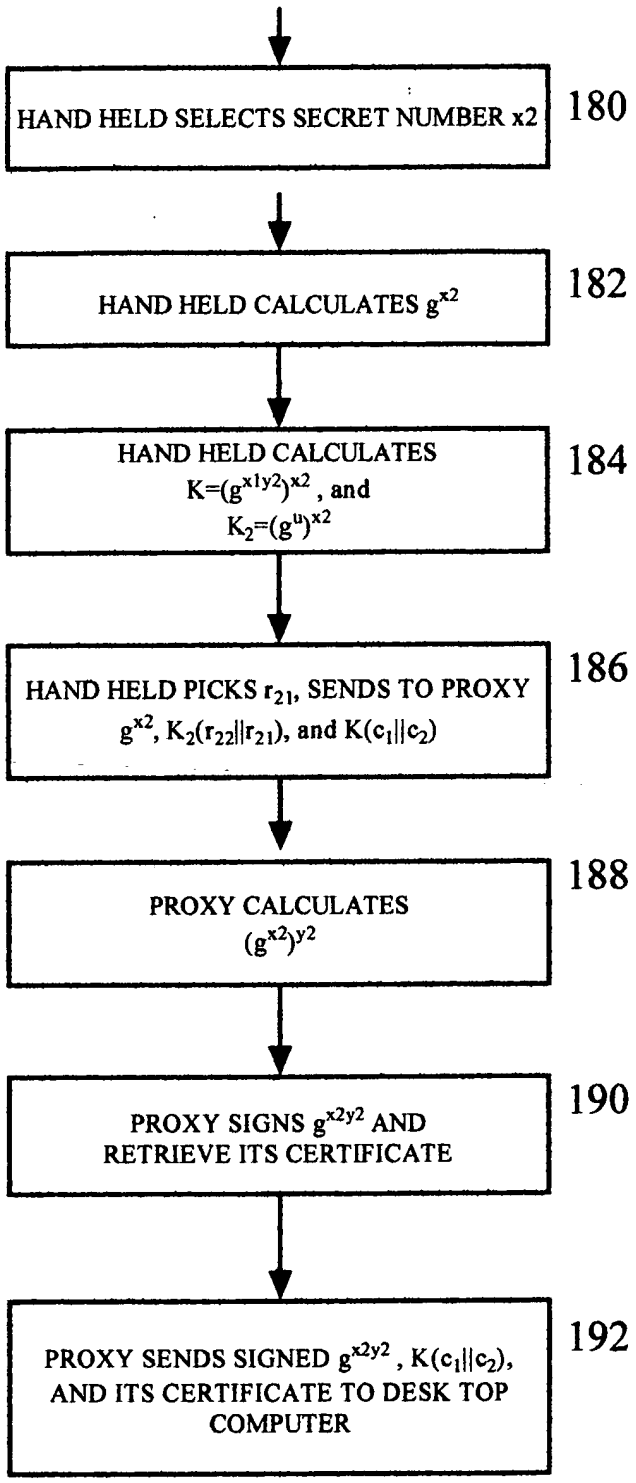
HAND HELD SELECTS SECRET NUMBER x2
180
HAND HELD CALCULATES g^{x2}
182
HAND HELD CALCULATES
$K=(g^{x1y2})^{x2}$, and
$K_2=(g^u)^{x2}$
184
HAND HELD PICKS r_{21}, SENDS TO PROXY
g^{x2}, $K_2(r_{22}||r_{21})$, and $K(c_1||c_2)$
186
PROXY CALCULATES
$(g^{x2})^{y2}$
188
PROXY SIGNS g^{x2y2} AND
RETRIEVE ITS CERTIFICATE
190
PROXY SENDS SIGNED g^{x2y2}, $K(c_1||c_2)$,
AND ITS CERTIFICATE TO DESK TOP
COMPUTER
192

FIG 17

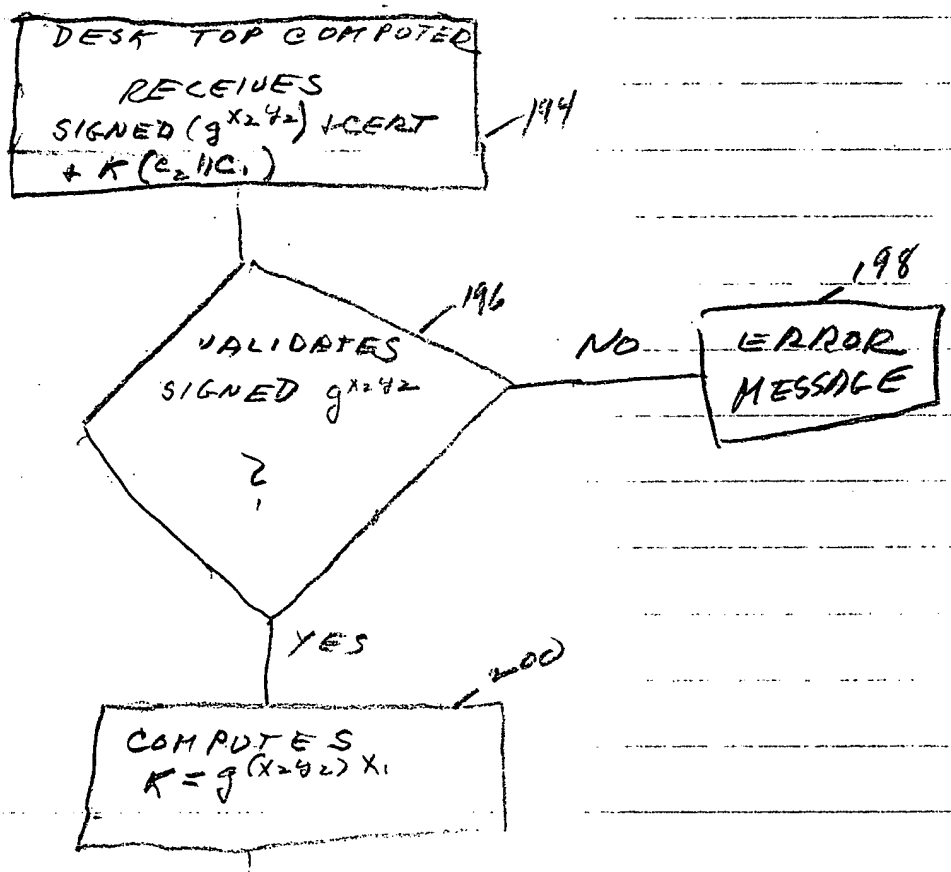
DESK TOP COMPUTER
RECEIVES
SIGNED ($g^{x_2 y_2}$) + CERT
$+ K(e_2, IC_1)$
194
VALIDATES
SIGNED $g^{x_2 y_2}$
?
196
NO
ERROR
MESSAGE
198
YES
COMPUTES
$K = g^{(x_2 y_2) x_1}$
200

FIG 18